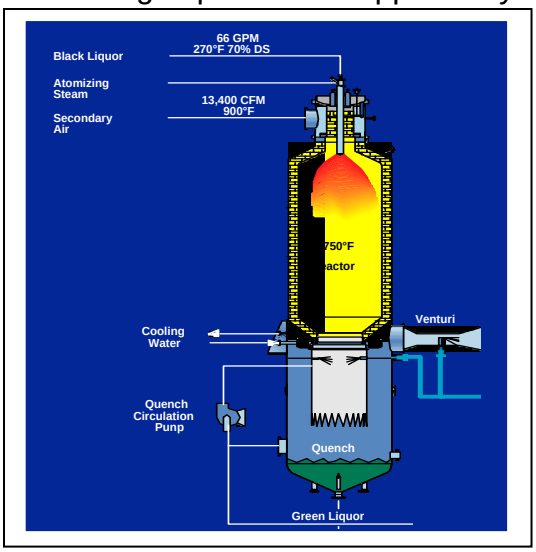
**EERE- New Refractories for Black Liquor Gasification Complete One Year of Continuous Service**

The development of black liquor gasification technology can lead to a tipping point - changing the pulp and paper industry from a consumer to a producer of energy. Gasification of black liquor with combined-cycle cogeneration of steam and electricity requires improved materials, including the refractory liners of gasifier vessels. There are 278 active black liquor recovery boilers in the United States. The majority of these boilers were built in the 1960s and 1970s, and only about 35 percent have since been rebuilt. Because boiler lifetimes range from 30 to 40 years, many of the current units will soon need to be replaced or rebuilt. These projected changes present an opportunity for standard recovery boilers to be replaced by more energy efficient black liquor gasifiers.




Current refractory materials used in gasifiers are too expensive and too short-lived (typically six months in plants that normally shut down only once a year) for widespread industry use. Refractories and other structural materials ideally would have lifetimes measured in 12 month increments to match existing plant maintenance schedules. The degradation of refractory materials also adversely affects the quality of the chemicals being recovered (green liquor), the operation of downstream equipment, and the structural integrity of the gasifier unit.

High alkali concentrations, high temperature (~950$^{o}$C) and severe gas/liquid flow characteristics inside gasifiers combine for a challenging environment for refractory materials. Sodium reacts with the refractory causing expansion of the surface, spalling, and the development of other mechanical /structural refractory faults. The physical loss of as much as 40 percent of some refractory material has been observed.
This degradation creates structural and safety problems, thermal efficiency losses, unacceptably high maintenance cost, and excessive downtime.

New, corrosion resistant, spinel refractory materials developed with funding from the Industrial Technologies Program (ITP), Office of Energy Efficiency and Renewable Energy (EERE) have passed their one-year operational milestone and remain in exceptionally stable condition. As part of the project “Materials for High-Temperature Black Liquor Gasification” new spinel refractory panels were installed in the black liquor gasifier at Weyerhaeuser Company’s New Bern, North Carolina mill in October 2004. The development work was performed at Oak Ridge National Laboratory with research partners from Weyerhaeuser Company, University of Missouri-Rolla, Process Simulations Limited, Simulent Inc., Vesuvius Monofrax, ANH Refractory Company, and SEPR Refractories.

The gasifier was recently shut down for one year inspection and maintenance. The experimental refractory bricks showed excellent corrosion and spallation resistance. Due to their exceptional performance, the new refractories were not replaced, and the system is now in the second year of operation. Conventional refractories that were put into service at the same time were replaced.

Close up of new refractory bricks showing drastically reduced spallation behavior.

Black liquor gasification results in a 14% improvement in energy efficiency over recovery boilers. Syngas produced by the gasification of black liquor can be converted to liquid fuels, power, or chemicals and yields a variety of financial options for pulp and paper mills. This technology can convert mills to energy exporters. In addition, an 18% reduction in $CO_2$ emissions, and reduction in NOx, $SO_X$ and particulates from pulping mills is expected.

A fact sheet on the project is available at:
http://www.eere.energy.gov/industry/imf/pdfs/16540_mat_black_liquor_gas.pdf

For more information on this project please contact;
Dr. Jim Keiser: phone (865) 574-4453
Email: keiserjr@ornl.gov